

# PATENT SPECIFICATION

710,799



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## COMPLETE SPECIFICATION

### Improvements in or relating to Small Electric Motors, in particular Rotating Field Motors

I, ANNA FRANZISKA KAISER, of 11, Schedelstrasse (Dutzendteich), Nuernberg, Germany, of German Nationality, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to small size induction motors, in particular rotating field motors, and more especially to motors for use in toy installations such as toy railways, toy automobiles and the like.

Electric motors are known to the art the casings of which consist of two parts. The ball bearings run in specially provided races inserted into the lateral parts of the housing.

Such motors, however, are relatively heavy and quite large and therefore not suited for use as fractional h.p. motors, particularly not for toy installations.

A motor according to this invention is characterised in that the outer casing comprises two cup-shaped parts which are secured to each other where they fit over and hold the outer motor element (stator or rotor) and which at their centres are shaped to provide tracks for anti-friction balls running on the shaft of the inner motor element (rotor or stator). In such an arrangement, the said balls in each bearing may be located axially by a shoulder or collar on the said shaft on the one hand, and by a cover plate or ring on the adjacent cup-shaped part on the other hand. Said shoulder may be the end of a reinforcing sleeve fitted on to the shaft, and the said cover plate or ring may be detachable from the cup-shaped part.

Preferably the said cup-shaped parts are made by deep drawing of sheet metal, and the said tracks also are formed by a drawing operation.

The said tracks at the centres of the cup-shaped parts may be conical, and it is further possible to provide for adjustable play.

The improved motor may be a synchronous motor and the arrangement may be such that the rotor rotates about, within or alongside the stator. Furthermore, several rotors rotating independently of one another may be associated with a common stator.

In order to attain the most favourable speed regulation the rotor is constructed so as to possess a relatively high internal resistance. To insulate the winding special intermediate layers of insulating material are employed in the usual manner for larger motors and individually inserted in each slot. In case of fractional h.p. motors, it is particularly advisable to combine the individual insulating layers to form two parts, as discs, sprayed from plastics, which may be alike and are placed in position from both sides.

The arrangement according to the invention with respect to the motor shaft may also serve for gear shafts to support them by means of balls on seatings drawn on or in the motor casing itself, or by means of built-on casings.

In the same manner other motor types, as universal D.C. and A.C. motors, may be constructed, though the exact centering in view of the necessarily narrow air gaps of induction motors is particularly advantageous.

One embodiment of the invention is illustrated, by way of example, in the accompanying drawings, wherein:—

Fig. 1 is a cross section of a motor in the direction I—I of Fig. 2;

Fig. 2 is an axial longitudinal section in the direction II—II of Fig. 1;

Figs. 3 and 4 show corresponding sections of a second construction;

Fig. 5 shows the arrangement of the motor shaft;

Fig. 6, the arrangement of gear shafts; and

Fig. 7 is a perspective view of a stator with an insulating disc having tubular extensions.

1 is the motor shaft provided with a sleeve 2 over which a rotor 3 is disposed which in its longitudinal direction possesses recesses 4. The rotor 3 consists for example, of iron. The recesses 4 are provided with particularly good conductive materials 5, as copper or aluminium. The portions 5 project in longitudinal direction beyond the rotor 3.

The stator is composed of individual stamped sheet metal discs 7 having for instance a shape like that shown in Figs. 1 and 7. Between the stator 7 and the rotor 3 a gap 8 is left which should be as small as possible. All parts are held in their proper relative position by covers 9 drawn from sheet metal and passed with their tubular portions 10 over the stator 7. Between the parts 9 of the cover remains a free gap 11. Inside the covers 9 for the casing drawn-in seatings 12 for balls 13 are provided. The balls 13 are held in axial direction by the sleeve 2 and the covering discs 14. A gear wheel 15 from which drive is derived is also disposed on the shaft 1. The winding (not shown) of the stator 7 terminates in the conductors R, S, T passed through an opening 16 of one of the covers 9.

The rotor 3 can be produced in an extremely simple manner. The recesses 4 can be stamped in the sheet metal discs 3, whereupon conductive material, as aluminium, is injected. An important feature is to keep the gap 8 between rotor and stator as small as possible. For this purpose serve the balls 13 which are supported by the drawn-in surfaces 12, the shaft 1 and the sleeve 2.

In the construction shown in Figs. 3 and 4 the arrangement is such that the stator 7' is on the inside and stands still while the rotor 3' rotates about it. 17 is the winding space. The sleeve 2 is replaced by two tubular members 18. The stationary shaft is secured to the frame or housing 19 of the toy and perforated on one side for leading in the conductors R, S, T. The end shields 9 are fitted with flanges 20 which take up between them a seal 21 and a cord groove 22 or the like serving as a pulley.

In other respects the arrangement of the balls 13 corresponds to that shown in Figs. 1 and 2.

The construction according to Fig. 5 shows that the drawn-in surfaces 12 may also be conical. It is further possible to provide for adjustable play. The liners 21 under the covering disc 14 may for instance be adjustable or differ in thickness. Otherwise, the mode of operation is the same as that described with reference to Figs. 1 to 4.

As stated before, it is further possible to arrange also gear shafts in a similar manner, either in the same motor casing or in mounted-on parts. Cylindrical or conical surfaces may then be used, as shown in Fig. 6 where 24 is a gear shaft on which a gear

wheel 23 is disposed and the balls 13 of the shaft 24 roll on drawn-in surfaces 12 of the casing 9. The walls 9' may be suitably connected together.

Fig. 7 shows in perspective the stator 7 consisting of a plurality of sheet metal discs in accordance with Fig. 1. A disc 25 made of insulating material, for instance by spraying, may be provided with tubular extensions 26 which may enter the spaces 17 for the winding. In this way, the winding is insulated from the stator 7 by the disc 25 and the tubular extensions 26. Each front side of the stator 7 is provided with such a disc 25.

In the construction according to Figs. 1 and 2 the two discs 25 can be seen, but the tubular extensions are not shown and may be omitted. Other motor types may be constructed in like manner.

What I claim is:—

1. A small electric motor, in particular a rotating field motor, of which an outer casing consists of two parts each enclosing a bearing for the motor shaft, characterised in that the outer casing comprises two cup-shaped parts which are secured to each other where they fit over and hold the outer motor element (stator or rotor) and which at their centres are shaped to provide tracks for anti-friction balls running on the shaft of the inner motor element (rotor or stator).

2. A small electric motor according to Claim 1, characterised in that, in each bearing the said balls are located axially by a shoulder or collar on the said shaft on the one hand, and by a cover plate or ring on the adjacent cup-shaped part on the other hand.

3. A small electric motor according to Claim 2, wherein said shoulder is the end of a reinforcing sleeve fitted on to the shaft, and the said cover plate or ring is detachable from the cup-shaped part.

4. A small electric motor according to any preceding claim, wherein the said cup-shaped parts are made by deep drawing of sheet, metal, and the said tracks also are formed by a drawing operation.

5. A small electric motor according to any preceding claim, characterised in that the said tracks for the balls are formed conically, with or without means for effecting an adjustable play.

6. A small electric motor according to Claim 4 or 5, characterised in that a geared driving shaft also is mounted on balls which are supported on tracks drawn on or in a sheet metal housing.

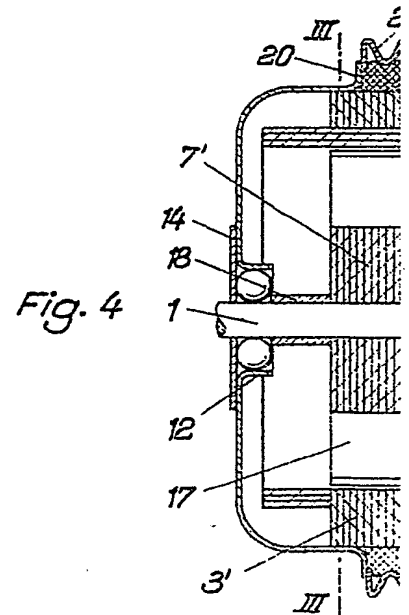
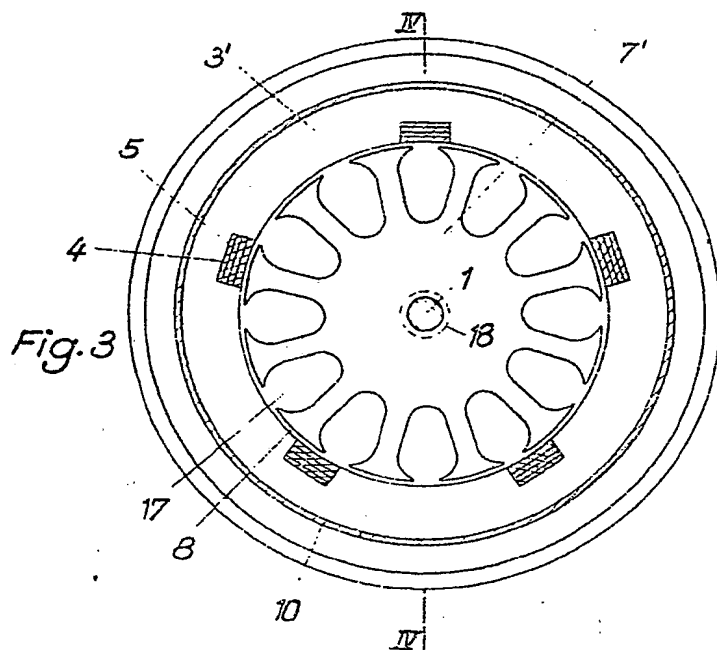
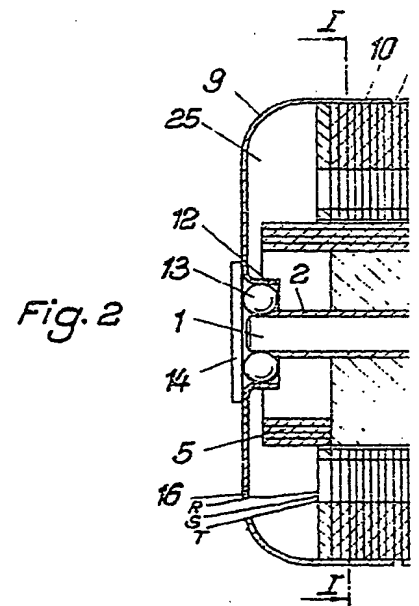
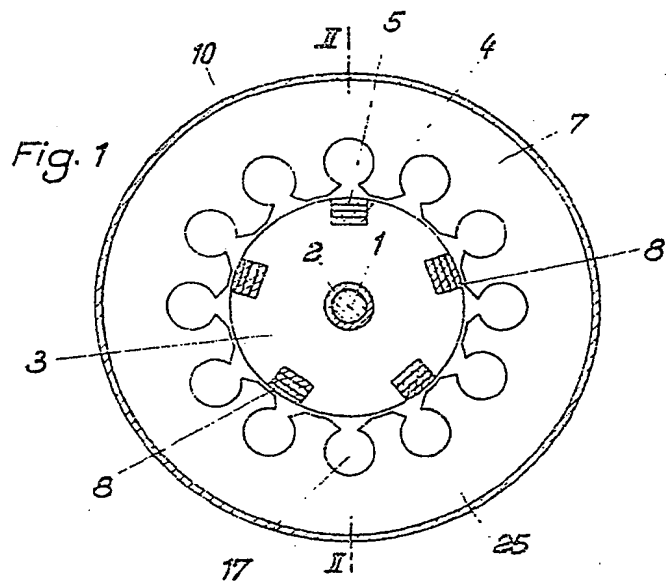
7. A small electric motor according to any preceding claim, characterised in that the two front sides of the stator, consisting of armature core discs, are each covered with a disc having tubular insets of insulating material which insulate the winding against

the armature core discs.

8. A small electric motor according to Claim 1 and substantially as herein described and illustrated in the accompanying 5 drawings.

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# 710,799 COMPLETE SPECIFICATION

3 SHEETS

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SHEETS 1, 2 & 3

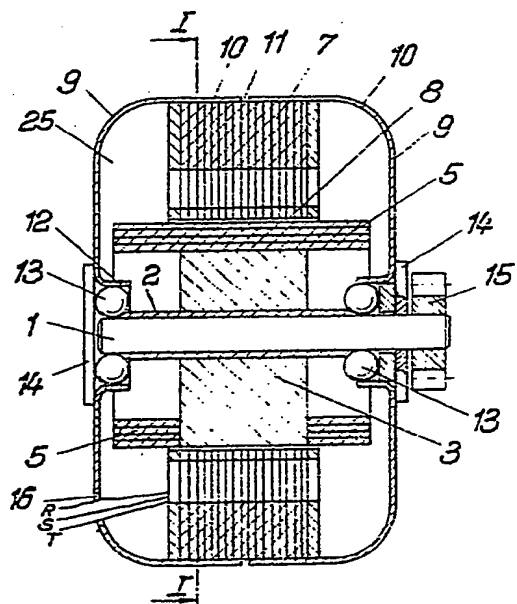


Fig. 5.

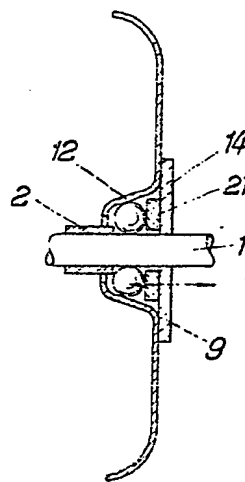


Fig. 6

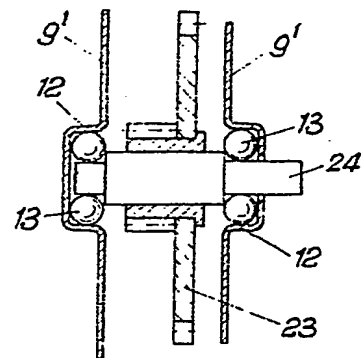
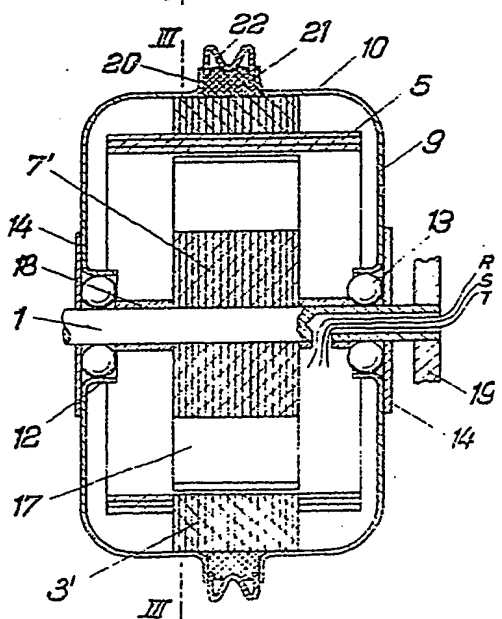
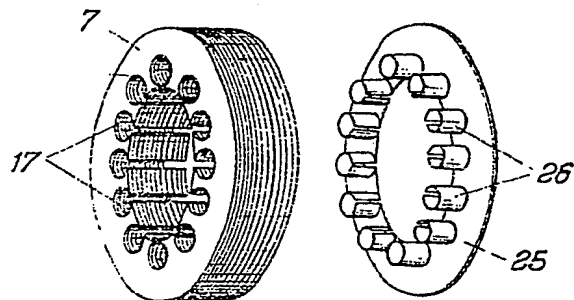


Fig. 7



710,799 COMPLETE SPECIFICATION  
 3 SHEETS  
 This drawing is a reproduction of  
 the Original on a reduced scale.  
 SHEETS 1, 2 & 3

